

## ABSTRACT

In the present study, Barti Raj Forest, Chagharzai Valley, Buner, KP, Pakistan was explored for its fungal flora. During the investigation, 28 mushroom taxa belonging to 11 families and 12 genera were collected, characterized and biologically screened for their pharmacological activities (antimicrobial, antioxidant and anticancer potential). Mushrooms were characterized on the basis of morpho-anatomical characters. Scanning electron microscopy (SEM) was also performed for analyzing the details of spore ornamentations. Out of 28 mushrooms, 10 species (*Clitocybe gibba*, *Hydum repandum*, *Inocybe rimosa*, *Laccaria amethystina*, *L. laccata*, *Ramaria stricta*, *Russula adusta*, *R. delica*, *Suillus flavidus* and *S. sibiricus*) have already reported from Pakistan. Three species viz; *Agaricus abruptibulbus*, *Hygrophorus occidentalis* and *Lepiota magnispora* are being reported first time from Pakistan while, rest of the 15 species (*Craterellus caulkiensis*, *C. flosus*, *C. rimosa*, *C. septocystidiosus*, *Gymnopus undulatus*, *Helvella compacta*, *Inocybe camelensis*, *I. longistipes*, *Lycoperdon pentagon*, *Russula bunerii*, *R. gulabiensis*, *R. lilacina*, *R. vermilliona*, *Suillus chagharziensis* and *S. septocystidius*) seem new to science on the basis of morphoanatomical characters.

Fourier Transform Infrared spectroscopic analysis of eight mushrooms (*Agaricus abruptibulbus*, *C. gibba*, *H. occidentalis*, *R. adusta*, *R. bunerii*, *R. delica*, *R. lilacina* and *R. vermilliona*) showed the presence of different antioxidant functional groups like alcohols, phenols, carbonyl and halogens. All *Russula* species showed diverse range of functional groups viz; O–H, C=C, C–O, C–H, C–F, C–Br and N–H while *A. abruptibulbus* and *C. gibba* also contained amine and sulfate groups as well. Resemblance and difference in functional groups also predicted the closeness of species within same genus and among different genera. Four *Russula* species viz; *R. adusta*, *R. delica*, *R. lilacina* & *R. vermilliona*) were selected for further investigation of their role as antibacterial, antifungal, antioxidant and anticancer agents.

Antibacterial potential of methanolic and chloroform extracts was determined by well diffusion method against four bacterial strains (*Bacillus subtilis*, *Bacillus licheniformis*, *Paenibacillus lautus* and *Escherichia coli*) at six different concentrations (250, 500, 750, 1000, 1250 and 1500 µg/ml). All the selected mushrooms showed good antibacterial potential, however, *R. vermilliona* showed remarkable zone of inhibitions

against all the bacterial strains. Methanolic extracts of mushrooms proved to be better antibacterial agents as compared to chloroform.

Antifungal potential of methanolic extracts of the selected mushrooms was determined by well diffusion method against two fungal strains (*Aspergillus flavus* and *Mucor mucedo*). All the selected mushrooms showed antifungal potential. *R. vermilliona* and *R. delica* represented good antifungal potential by forming inhibition zones upto 6mm and 7mm respectively as compared to *R. lilacina* and *R. adusta* which formed 4 and 5mm inhibitory zones respectively. The antifungal potential was in order *R. delica* > *R. vermilliona* > *R. adusta* > *R. lilacina*.

The antioxidant potential of methanolic and chloroform extracts of selected mushrooms was determined by using 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay. Chloroform extract of *R. vermilliona* showed a remarkable antioxidant potential of 89%. *R. adusta*'s methanolic extract showed 86%. Methanolic extracts of *R. delica* and *R. lilacina* showed 49% and 52% antioxidant potential respectively.

Furthermore, *R. vermilliona* was also investigated for its anticancer potential. The shielding effect of aqueous extract of *R. vermilliona* extract CCl<sub>4</sub> induced hepatotoxicity in Balb C mice was examined. The alteration in enzyme activities of blood plasma was observed as CCl<sub>4</sub> induced hepatotoxicity caused elevation in ALAT, ASAT, ALP, LDH and MDA while a decrease in catalase level was observed. It also caused an increase in bilirubin content while decline in plasma protein level was observed. When *R. vermilliona* extract was injected intraperitoneally, it ameliorated the damaging effect caused by CCl<sub>4</sub>. Hence, *R. vermilliona* extract obliterated the hepatotoxic effects caused by CCl<sub>4</sub>.

Barti Raj forest proved to be a good fungal diversity spot. Many species seems new to science on the basis of morpho-anatomical characters while some are reported first time from Pakistan. The selected mushrooms also showed good biological screening properties which could be bench mark in pharmaceuticals as well.